
**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan****Santa Anita Stormwater Flood Management and Seismic
Strengthening Project****INTRODUCTION**

The Santa Anita Stormwater Flood Management and Seismic Strengthening Project (Project) will modify four existing facilities along Santa Anita Wash. These facilities are the Santa Anita Dam (Dam), the Santa Anita Debris Basin (Debris Basin), the Santa Anita Headworks (Headworks), and the Santa Anita Spreading Grounds (Spreading Grounds). These facilities, which are operated and maintained by the Los Angeles County Flood Control District (District), serve to control and conserve the floodwaters of the Santa Anita Canyon watershed. This watershed is mostly undeveloped with the majority of it located in the Angeles National Forest within the San Gabriel Mountains, which are very steep and among the most highly erosive mountains in the world. This watershed is also susceptible to wildfires, which result in tremendous debris flows during subsequent storm events. The facilities are located within one mile of the Sierra Madre Fault, which is capable of producing a maximum credible earthquake (MCE) of magnitude 7.5.

Goals and Objectives

This Project will improve District facilities to better manage stormwater runoff from the Santa Anita Canyon watershed and achieve the following goals: 1) reduce flood damage to the downstream communities, 2) increase recharge of the local groundwater basin and 3) improve public safety by remediating seismic safety issues at the Dam and the Debris Basin.

The Greater Los Angeles County Integrated Regional Water Management (IRWM) Plan includes regional objectives to promote an integrated, multi-benefit, inter-regional approach to water management and planning. The objectives included in the IRWM Plan that relate to the Project include: Sustain Infrastructure for Local Communities to maintain and enhance public infrastructure related to flood protection, water resources, and water quality; and Improve Water Supply to optimize local water resources to reduce the Greater Los Angeles Region's reliance on imported water.

In addition to meeting needs to improve infrastructure for flood protection and water resources, the Project is critical to the success of regional efforts to reduce dependence on imported water supplies. Enhancing regional self-reliance looms as an immediate and immense challenge. Underscoring the scale of the challenge, the Metropolitan Water District of Southern California has estimated that Southern California could face a potential gap between demand and supply of up to 1,300,000 acre-feet/year (AFY) by the year 2025 if new water supply

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

projects are not developed. The adopted IRWM Plan estimates a potential water supply gap of 800,000 AFY for the Greater Los Angeles Region.

Purpose and Need

Background/History

Santa Anita Dam

The Dam is a constant-angle variable-radius concrete arch dam located 2.5 miles north of the City of Arcadia in the San Gabriel Mountains. The Dam is 225 feet high and 612 feet wide. The Dam has a sluice gate, three outlet control valves, and three uncontrolled (un-gated) spillways (see Figure 3.1, below). The Dam, completed in 1927, was designed to capture stormwater runoff, including its debris, and to attenuate (reduce) peak runoff flow rates from the upper 10.8 square miles of the Santa Anita Canyon watershed. The dual purposes of the Dam are flood control protection from stormwater runoff and debris and conservation of the stormwater runoff for release to downstream facilities for groundwater recharge and subsequent pumping for local water supply. The Dam, which is under the jurisdiction of the California Department of Water Resources Division of Safety of Dams (DSOD), protects the cities of Arcadia, Monrovia, Temple City, El Monte, and unincorporated areas of Los Angeles County. The Dam does not meet current standards for withstanding a MCE or safely passing a probable maximum flood (PMF).

Santa Anita Debris Basin

The Debris Basin is a 56-foot high earth embankment dam constructed in 1960 by the U.S. Army Corps of Engineers (USACOE) for debris control and water conservation (see Figure 3.2). The Debris Basin is located just over one mile downstream of the Dam and has an original capacity of 245 acre-feet. The Debris Basin has a sluice gate and a spillway consisting of an un-gated, concrete-lined rectangular open channel, located within the embankment near the left abutment. The spillway is approximately 160 feet wide and has a capacity of 38,000 cubic feet per second (cfs), which is adequate to pass the PMF. The outlet works allow water to be sent from the Debris Basin to the Spreading Grounds.

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

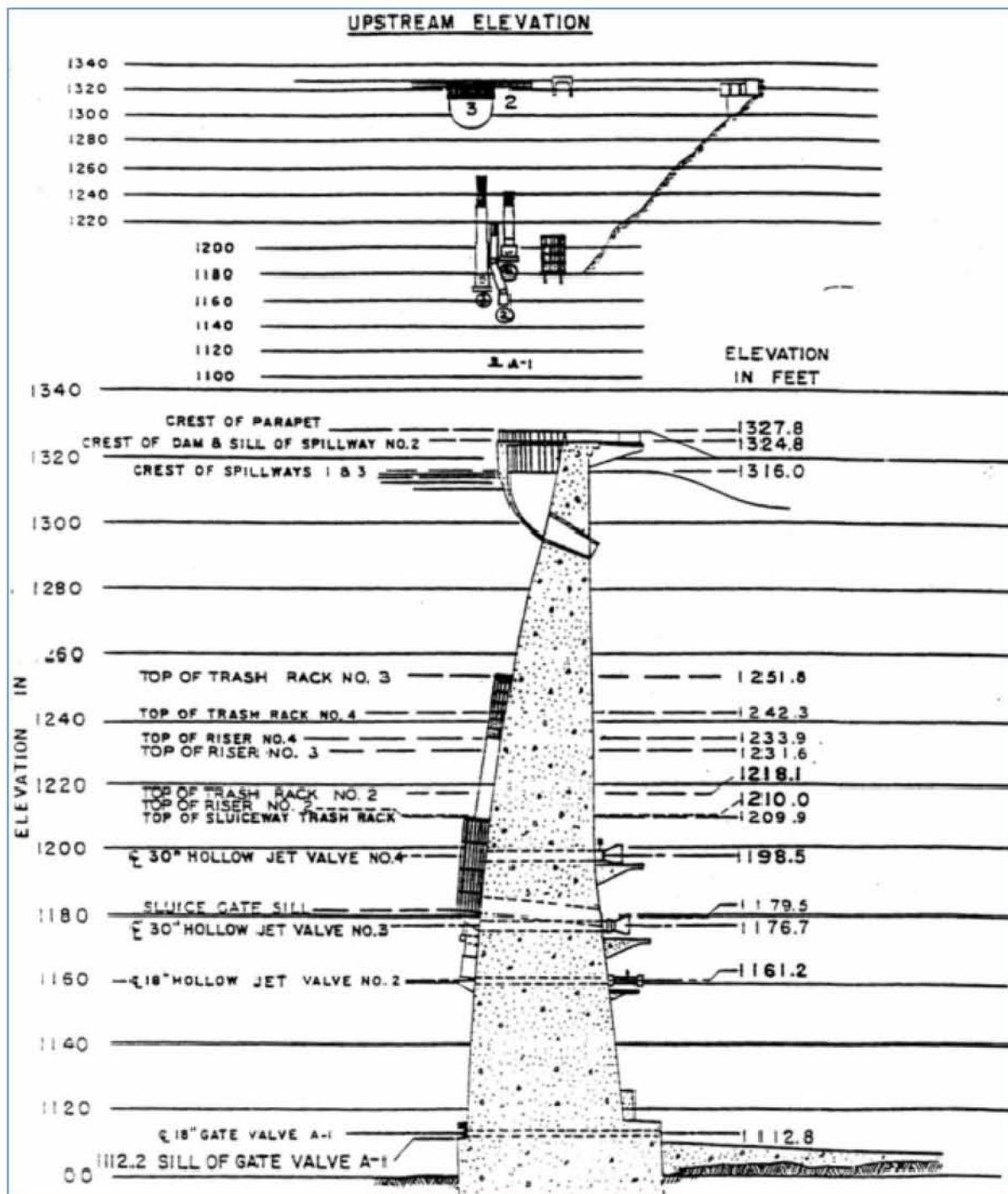


Figure 3.1. – Santa Anita Dam

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

After its completion, the Debris Basin was transferred from the USACOE to the District for operation and maintenance. The Debris Basin became subject to jurisdiction of DSOD in 1982. Upon review of the Debris Basin, DSOD determined that it did not meet standards for seismic safety and required the outlet gate to remain open at all times to prevent storage of water. Since then, the water conservation activities at the Debris Basin have ceased and it serves only to capture debris flows from the portion of the watershed between the Dam and the Debris Basin.

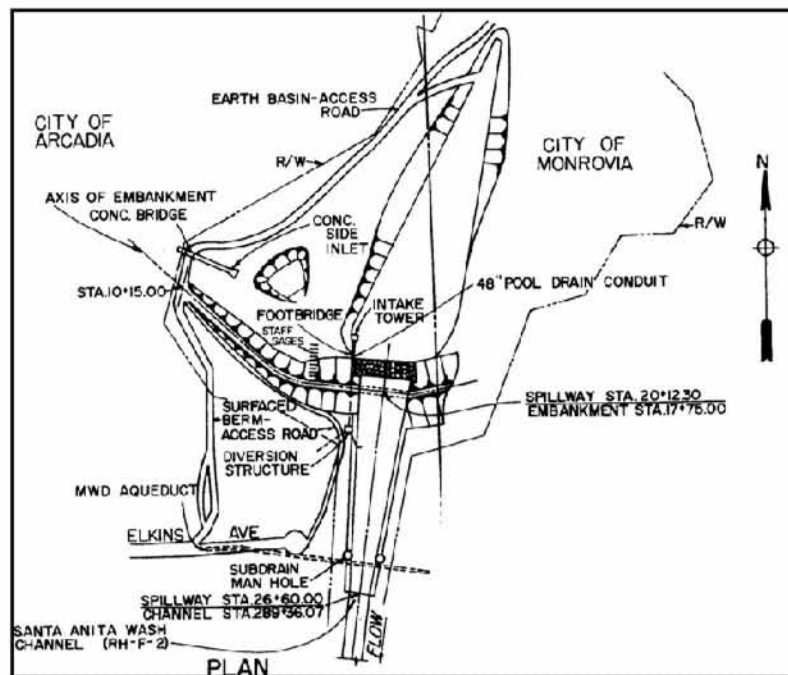


Figure 3.2 – Santa Anita Debris Basin

Santa Anita Headworks

The Headworks structure is located downstream of the Dam and upstream of the Debris Basin in the City of Arcadia. The Headworks intercepts flows released from the Dam and redirects portions of that flow to the Spreading Grounds and/or the Sierra Madre Spreading Grounds, where the water is recharged into the local groundwater basin (East Raymond Basin). The Headworks can also allow the Dam releases to continue downstream to the Debris Basin. The Headworks primarily consists of an earthen levee, a bypass channel with a tainter gate, and manual diversion gates, one each for the two different spreading grounds.

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

Figure 3.3 - Headworks

Santa Anita Spreading Grounds

The Spreading Grounds, which were constructed in 1944 by the District, are located in the City of Arcadia, adjacent to the Santa Anita Wash and downstream of the Debris Basin (See Fig 3.4). These Spreading Grounds are operated by the District to percolate storm flows from Santa Anita Canyon into the East Raymond Basin. The Spreading Grounds were constructed on 20 acres of land, consisting of 12 shallow basins covering eight (8) wetted acres with a storage capacity of 25 acre-feet. The basins are separated from each other by levees and water flows through inter-basin weir structures by gravity.

The Sierra Madre Spreading Grounds, which are located in the City of Sierra Madre (City), are operated by City staff to recharge the East Raymond Basin. Staff from the District, in coordination with City staff, operate the Headworks to direct water to the Sierra Madre Spreading Grounds from the Headworks. By operating the diversion gate at the Headworks, up to 30 cfs can be directed into a pipeline to the Sierra Madre Spreading Grounds. The Sierra Madre Spreading Grounds have a storage capacity of 30 acre-feet. The proposed Project does not involve any work at the Sierra Madre Spreading Grounds; however, the Project will result in additional stormwater being directed to the Sierra Madre Spreading Grounds for increased local groundwater recharge.

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

Figure 3.4 – Santa Anita Spreading Grounds

The Region has experienced significant reductions in imported water supplies due to recent drought conditions in Northern California, ongoing drought conditions in the Colorado River watershed, and from regulatory actions and court decisions that have reduced exports from the Sacramento-San Joaquin Delta. In addition, the effects of climate change may make imported water supplies less reliable. Thus, the Region needs to increase the utilization of local water supplies and reduce dependency on imported water.

The East Raymond Basin is a subarea of the overall Raymond Groundwater Basin. There are currently two domestic water purveyors that overly this area with extraction facilities (wells); the City of Arcadia and the City of Sierra Madre.

Project Need

Each of the following four project components discussed below is needed to meet the Project's goals.

Santa Anita Dam

The Dam does not meet spillway or seismic requirements. Consequently, DSOD directed the District to modify the Dam. If the Dam were to fail with a full reservoir, the resulting flows would inundate an area covering 7.5 square miles. Within this area, there are 12 schools, over 12,000 single-family residences, over 1,300 multi-family residences, two fire stations, and two libraries. In addition, there are over 900 commercial, industrial, and institutional buildings that would be destroyed. Damage would also occur to the downstream debris basin, spreading grounds, flood control channels, and streets and bridges, including the 210 freeway.

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

If a significant storm event were to occur which exceeds the spillway capacity of the Dam, the uncontrolled overtopping of the Dam by stormwater runoff could erode the abutments or undermine the Dam, resulting in a dam failure. A new spillway is required to safely pass the PMF and eliminate the potential for downstream flood damage resulting from a dam failure.

If a major earthquake were to occur with a full reservoir behind the Dam, the Dam could also fail. Since 1979, DSOD has restricted how much water can be held behind the Dam until the District implements a remediation project to address the seismic deficiency. While developing concepts for seismic remediation, the District conducted state of the art seismic studies, including finite element analysis of the Dam, which determined that the recommended long-term reservoir elevation was much lower than the restricted elevation previously set by DSOD.

As a result, DSOD has lowered the restricted reservoir elevation and directed the District to accelerate its remediation efforts. If the District does not implement a mitigation project, DSOD will require the Dam's gates to be locked open and the valves to be removed, which would reduce flood control capabilities and eliminate water conservation storage at the Dam.

The Dam's structural concrete is in need of repair. There are several areas with leaking joints and spalling concrete. Joint grouting and concrete repair is needed to ensure the concrete meets acceptable standards and that the strength of the concrete is consistent with the values used to model the seismic performance of the Dam.

A seismic remediation project is needed to reduce risk of a dam failure, to mitigate impacts, and restore capabilities for conservation of stormwater runoff.

In addition, the Dam's electrical, mechanical, and control systems, constructed in the 1920's are beyond their useful lives and in need of replacement. These new systems, along with upgrades to the Headworks and Spreading Grounds, are needed to ensure reliability and to modernize operations allowing integrated control of the facilities to increase water conservation efficiency.

To ensure safe performance of the Dam, dam safety instruments including joint and crack meters, piezometers, water level sensors, leakage weirs and accelerometers need to be automated for remote monitoring.

Santa Anita Headworks

The Headworks becomes impacted when the Dam outflow exceeds 75 cfs, the maximum capacity of the Headworks' tainter gate. The tainter gate can direct flow to the two spreading grounds diversion gates. One gate diverts flow, up to 30 cfs, to the Sierra Madre Spreading Grounds. The other gate diverts flow, up to 15 cfs, to the Santa Anita Spreading Grounds. Any

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

flow not diverted to either of the spreading grounds will continue past the tainter gate and be directed downstream past the Wilderness Park to the Debris Basin.

As flows approach 75 cfs, the tainter gate must be fully opened to prevent damage, precluding the ability to send flows to either of the spreading grounds. This occurs several times annually resulting in stoppage of water conservation activities. As flows recede, the tainter gate can again be operated, resuming water conservation activities. When flows exceeding 300 cfs are released from the Dam, the Headworks' earthen levee can be overtopped and potentially washed out. When this occurs, water can no longer be diverted by the Headworks to the Santa Anita Spreading Grounds or to the Sierra Madre Spreading Grounds until repairs are made to the levee. Repairs to the levee usually take a few days or several weeks depending on the amount of stormwater runoff required to be released from the Dam and this delay results in significant loss of groundwater recharge at the spreading grounds. When the levee washes out, the flows can also wash out the road and culvert bridge serving the Arcadia Wilderness Park, a public park. This levee failure resulting in loss of water conservation and impacts to Park access is expected to occur during a 2-year storm event (a storm event likely to occur every two years, or that has a 50% chance to occur in any year).

A rehabilitation of the Headworks is needed to protect facilities from stormwater damage and to ensure ability to direct stormwater runoff to the spreading grounds for groundwater recharge. The rehabilitation of the Headworks will include new gates and control systems, including remote operation capabilities to increase efficiency of water conservation operations. Currently, whenever changes to the flow rates to be delivered to either of the spreading grounds is needed, field crews must be contacted and sent to make manual adjustments to the gates. The response time required to make these adjustments results in lost water conservation.

Santa Anita Debris Basin

The Debris Basin provides flood protection by capturing sediment laden stormwater runoff and discharging clear stormwater runoff to the channel downstream. If the Debris Basin were to sustain damage or to fail as a result of seismic activity, debris would be deposited in the downstream channel, reducing the ability to safely convey subsequent storm flows in the channel through the communities resulting in flood damage. In addition, a Debris Basin failure would result in the Spreading Grounds being washed out and incapable of recharging stormwater runoff into the underlying groundwater basin.

As a result of the upstream Dam's loss of water conservation capacity, there is an increased need to capture as much stormwater runoff as possible below the Dam. Remediating the seismic deficiencies at the Debris Basin will result in DSOD removing the operational restrictions on the facility, thus restoring 118 acre feet of water conservation capacity. As captured

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

stormwater is released to the Spreading Grounds for groundwater recharge, the Debris Basin can then capture more runoff from upstream, thus using the capacity multiple times depending on the frequency, duration, and intensity of storm events.

Santa Anita Spreading Grounds

The Spreading Grounds are currently operable; however, there is a need to increase their capacity, percolation rate, and operating efficiency to improve groundwater recharge to the East Raymond Basin. Without the proposed Project, stormwater directed to the Spreading Grounds moves too quickly through the basins and out through the overflow structure at the downstream end due to leaking levees, inefficient inter-basin weirs, a small storage capacity, and limited control capabilities. Because there is a limited period of time during and after each storm season to capture and recharge stormwater runoff, modification to the Spreading Grounds is necessary to increase their storage and operational capacity and ensure their operation is optimized to work with the upstream facilities. The resulting additional water conservation is needed to recharge the East Raymond Basin aquifer to supply water to the City of Arcadia. The City relies on the East Raymond Basin for its water supply, since it does not have any alternative water delivery infrastructure in place to meet its needs.

The water purveyors of the East Raymond Basin are both experiencing decreased water levels and water quality concerns in some wells. There is a need to increase recharge into the Basin and reduced contaminants.

Project List

The Santa Anita Stormwater Flood Management and Seismic Strengthening Project is the only project being submitted in this proposal. The Project has multiple components that satisfy the program eligibility requirements of the Proposition 1E grant and will meet the goals discussed previously. While each component on its own provides benefits, it is through their linkages and synergies that the benefits are optimized to meet in the overall Project goals and objectives. The Project will be constructed in phases. The following information describes the status of each of the Project's components.

Santa Anita Dam

To address seismic safety concerns, a 6-foot diameter, 50-foot tall concrete outlet tower will be constructed on the upstream Dam face which will discharge any reservoir water above an elevation of 1230 feet, the maximum safe long term water surface elevation allowed by DSOD. The tower will be able to function after a MCE. The outlet tower will be connected to the

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

existing sluice tunnel and will have a maximum discharge capacity of 1,000 cfs. Construction of the outlet tower will allow the District to operate a water conservation pool of 196 acre feet. The Dam will also serve as a settling pool to remove sediment from dam inflows to ensure that the water quality is adequate for the downstream spreading grounds.

To ensure the integrity of the Dam's structural concrete, leaking joints and cracks will be grouted and spalling concrete will be repaired.

To reduce the risk of dam failure due to uncontrolled overtopping during major storm events, a new spillway will be added to ensure that the Dam can safely pass the PMF. In addition, armoring of the downstream canyon walls and the toe of the dam will be done to ensure that they will safely withstand the flows from the new spillway.

To better manage stormwater runoff and ensure reliability and efficiency of operations, three new valves will be installed, along with new electrical and control systems, including automated operation and instrumentation capabilities. A new hoist will be required to facilitate spillway construction and future maintenance. The existing hoist must be removed since it is in the new spillway location.

To ensure safe performance of the Dam, dam safety instruments including joint and crack meters, piezometers, water level sensors, leakage weirs and accelerometers will be automated for remote monitoring.

Santa Anita Debris Basin

Remediation of the seismic deficiencies at the Debris Basin will consist of the following improvements: 1) replacement of the spillway tower due to inability of the existing tower to resist seismic loading, 2) replacement of a portion of the Debris Basin embankment subject to liquefaction, and 3) reconstruction of the spillway to address concerns with settlement/separation between the spillway and the embankment and to remove potential for failure in bending of the spillway walls. These improvements will allow DSOD to remove the current operating restriction, which will increase the Debris Basin's available storage capacity from 0 acre-feet to 118 acre-feet.

A new automated outlet gate and control system will be constructed to modernize operations and ensure compatibility with other Project components.

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**Santa Anita Headworks

Rehabilitation of the Headworks structure will include: 1) reconstruction of the levee to ensure it can withstand flow of up to 1000 cfs; 2) armoring of the roadway and construction of a new culvert bridge to the Arcadia Wilderness Park to ensure the roadway and bridge can withstand flow of up to 2000 cfs; 3) removal of the tainter gate and replacement with an Obermeyer Gate to allow for continued capability to divert flows through the spreading grounds diversion gates; 4) installation of new automated spreading grounds diversion gates; and 5) installation of new control systems integrated with the control systems of the other Project components to optimize water conservation. A critical component of the Headworks' control system is remote operation capability to allow for changes in flow rates to each of the spreading grounds based on available capacity.

Santa Anita Spreading Grounds

The Spreading Grounds enlargement and enhancement will be completed in two phases. Phase I consists of the construction of three new basins, modification of basin two and the canal, raising some levee elevations, and the enlargement of the remaining basins. Phase II consists of improving the operability and capacity of the spreading grounds. Operability improvements include the armament of the eastside canal, modifying the inter-basin weirs and replacing manual gates and flash-board structures with automated electrical gates and control systems. The two phases of work will result in a total increase of 15.1 acre-feet of storage capacity.

Status

Construction of the Santa Anita Dam outlet tower is currently in progress under a construction contract awarded May 2011. The design and construction costs of the outlet tower, which occur between September 30, 2008 and September 1, 2011, will be used as part of the local match for the grant funding.

Construction by the District of the Spreading Grounds Phase I was initiated in June 2009 and completed in September 2009. Its design and construction costs, which occurred after September 30, 2008, will be used as part of the local match for the grant funding.

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

The following table provides the design status of Project Components:

| Project | Abstract | Status (% Design Completion) | Implementing Agency |
|---|--|---------------------------------|--------------------------|
| Santa Anita Stormwater Flood Management and Seismic Strengthening Project | Modifications to Los Angeles County Flood Control District's flood control and water conservation facilities in the Santa Anita Canyon to address seismic strengthening and better management of stormwater runoff from the watershed will increase safety and reduce flood damage to the downstream communities resulting from large storms or seismic events. The modifications will also increase recharge of the local groundwater basin by an average of 518 acre feet per year. The Project includes the following components: <u>Santa Anita Dam</u> Seismic remediation with construction of outlet tower Spillway modification; structural repairs; electrical/mechanical and control systems | 100 30 | District |
| | <u>Santa Anita Debris Basin</u> Seismic remediation, mechanical and control systems upgrades | 30 | District |
| | <u>Santa Anita Headworks Rehabilitation</u> Mechanical and control systems upgrades | 60 | District |
| | <u>Santa Anita Spreading Grounds</u> Phase I- construct three new basins (15.1 additional acre-feet of capacity), and repair leaking and structurally unsound levees Phase II- construct new inter-basin structures and modify overflow weirs and, add new gates and control systems | 100 60 | District District |

Work Plan

As discussed above, there is only one Project in this proposal, the Santa Anita Stormwater Flood Management and Seismic Strengthening Project, which has multiple components to be implemented in a phased approach. It is through the synergies and linkages among the components that the Project is able to meet the overall Project goals and objectives. Combined, the Project components result in a substantially reduced flood risk from major storm events and earthquakes to downstream communities and infrastructure. In addition, implementation of the Project will allow the District to better manage stormwater runoff by increasing storage capacity of the facilities by 329.1 acre feet and optimizing operations through automated gates, valves and control systems. Project implementation will result in an average annual increase to groundwater recharge of the East Raymond Basin of 518 acre feet.

The map displays the Raymond Basin, outlined in black, covering parts of Los Angeles and San Bernardino counties. Key locations within the basin include Altadena, Pasadena, and San Marino. Major roads shown are I-210, I-710, and SR-138. The map also features the Santa Anita Dam, Santa Anita DB, and Headworks, all highlighted in yellow boxes. The Angeles National Forest and various mountains like Markham and Harvard are also visible.

Figure 3.5 – Regional Map

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan****Completed Work:**

The Spreading Grounds Modification Phase I was initiated June 2009 and completed September 2009. Accomplishments of Phase I consists of the construction of three new basins, modification of basin 2 and the canal, raising some levee elevations, and the enlargement of the remaining basins.

The Dam seismic remediation, consisting of an outlet tower capable of resisting the MCE to maintain the Dam at the maximum safe long term reservoir elevation, includes completed design work initiated after September 30, 2008 and construction work initiated May 27, 2010 which will be completed by September 1, 2011. The CEQA documentation has been completed and permits have been acquired for this phase of the Project.

The 60% design for the Spreading Grounds Phase II and Headworks rehabilitation components and the 30% design for the Dam Spillway component and Debris Basin rehabilitation component are complete as well. 100% Plans for the Santa Anita Dam Seismic Remediation / Outlet Tower and Spreading Grounds Phase I are included in Appendix 3-C.

Existing Data and Studies:

Several assessments and evaluations of the Dam, Debris Basin, Headworks and Spreading Grounds were conducted by District consultants in the past.

Montgomery Watson Harza, now MWH, performed engineering analysis and conceptual design for the seismic remediation and spillway modifications of the Dam. In their November 2005 Report for Santa Anita Dam Reanalysis Study Phase 2-Concept Validation and Preliminary Design, they provide two concepts for seismic remediation to meet DSOD's MCE requirements; a partial buttress, and an Intake Riser Modification. Both concepts included different options to meet DSOD's PMF requirements. The District has decided to pursue the Intake Riser Modification (referred to in this grant application as Seismic Remediation/New Outlet Tower). The District has also determined that the buttress concept may be pursued in the future to further increase the water conservation capacity of the Dam, but cost and environmental impacts preclude pursuing this option at this time (Not a part of this Project and not required to meet any of the benefits claimed for this Project). The new spillway to be constructed as part of this Project will be compatible with a future partial buttress concept. The spillway will be a notch spillway with a 6-foot diameter octagonal orifice spillway with an upstream invert at elevation 1,270.

Several Technical studies have been performed for the Santa Anita Debris Basin. Woodward-Clyde Consultants performed studies beginning in 1990 including field investigations, laboratory soils testing, and simplified seismic analysis as summarized in their 1994 Report, attached. The

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

report had the following conclusions from the seismic evaluation: The potential for surface fault rupture appears low; there is a potential for seismically induced liquefaction of the dam embankment but it would not result in flow-type behavior; the potential for liquefaction of the foundation alluvium is relatively low; there is a potential for differential settlement of the spillway slab; the spillway walls do not have sufficient moment capacity; and the intake tower is not stable under seismic loading.

In 2002, URS was contracted to provide additional investigation. Because of DSOD's concern about the integrity of the over-the-embankment spillway after an earthquake, URS conducted a study and developed a concept (30% design) in May 2004 for relocating the Santa Anita Debris Basin Spillway to the left abutment.

For the Spreading Grounds work, the District contracted with Leighton Consulting, Inc. to perform Geotechnical Evaluation of the Spreading Grounds and its existing levees. A copy of their October 2006 report is attached.

In the course of preparing the Economic Analysis for this Project, the District has performed hydrologic modeling for water conservation values for the "With Project" and "Without Project" scenarios. This assessment is included in the Appendix 8-C.

| Assessment and Evaluation Submittals | Dates | Appendix |
|---|---------------|----------|
| Memo – Santa Anita Dam Inundation Area | August 1973 | 7-A |
| Memo – Santa Anita Debris Basin Inundation Area | October 1973 | 7-A |
| Santa Anita Debris Basin Woodward-Clyde Consultants Report | August 1994 | 3-A |
| Santa Anita Debris Basin URS Report | May 2004 | 3-A |
| Existing Condition Assessment Report Santa Anita Seismic Reanalysis and Spillway Modification Study | April 2000 | 3-A |
| Santa Anita Dam Reanalysis Study Phase 2- Concept Validation and Preliminary Design -MWH Report | November 2005 | 3-A |
| Geotechnical Evaluation of the Santa Anita Spreading Grounds by Leighton Consulting, Inc. | October 2006 | 3-A |
| Santa Anita Debris Dam – Work Plan | April 2009 | 3-A |
| Foothill Water Coalition Water Supply Reliability Program | June 2009 | 3-A |
| East Raymond Basin Water Resources Plan | January 2011 | 9-A |

* All Existing Studies (relevant pages) are included in Appendixes. Full digital copies are included on CD.

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

Project Map

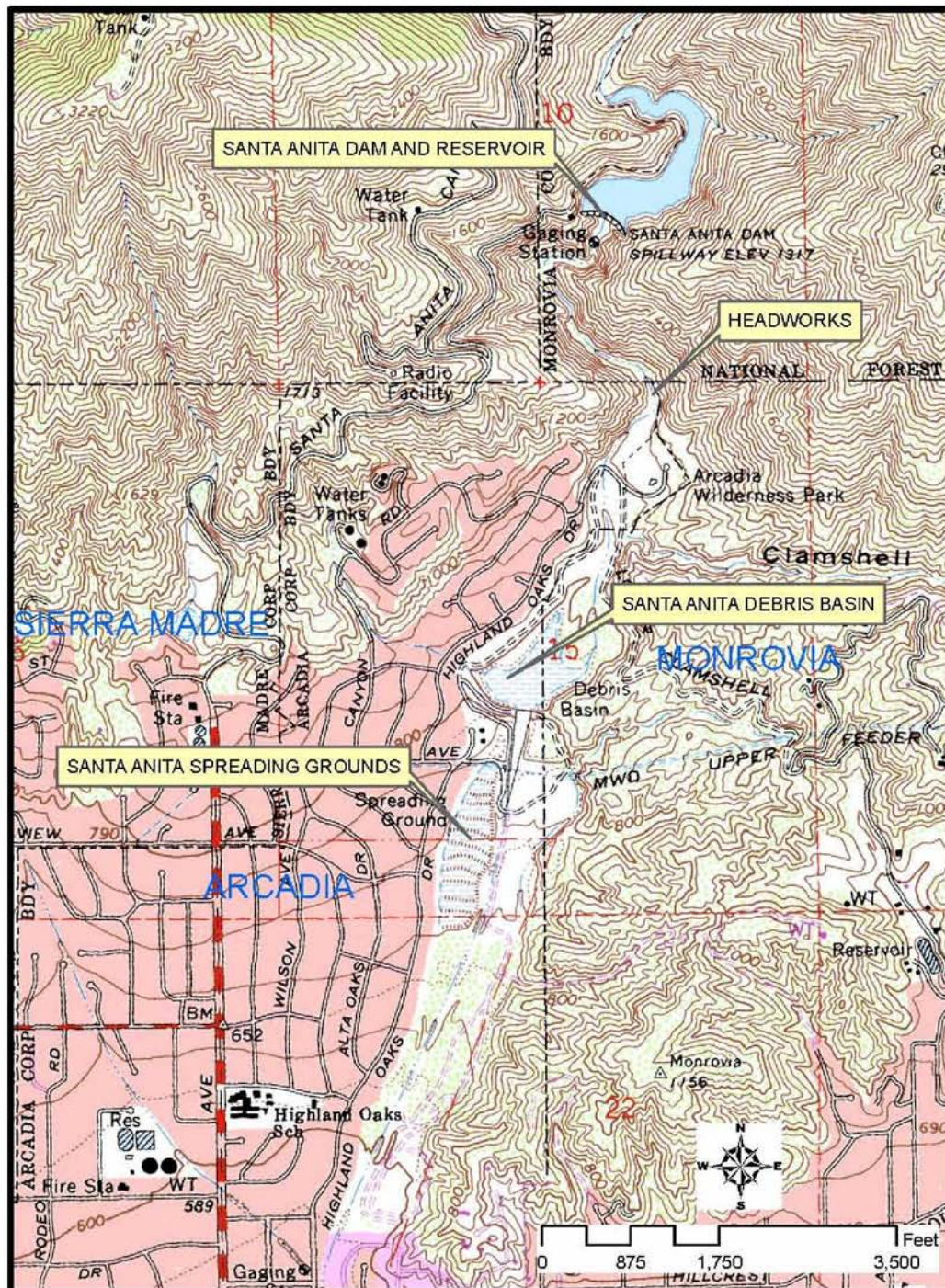


Figure 3.6 - Project Map

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

Project Specifics

The Project is located within Los Angeles County and has no operations and maintenance liability associated with the Sacramento River and San Joaquin River Flood Control System.

Project Timing and Phasing

The proposed Project is not dependent on the implementation of other projects. The Project can operate on a stand-alone basis, since it will be fully functional without subsequent projects. The Project contains several components that will be implemented in phases. Each component has stand-alone benefits; however, the overall Project is designed to maximize those benefits by integrating the operation and functioning of the components so they work together.

Phases of the Project are as follows:

| Items | Start Date | Completion Date |
|---|------------|-----------------|
| <u>Phase I</u> | | |
| • Santa Anita Dam Seismic Mitigation/Outlet Tower | May 2010 | September 2011 |
| • Spreading Grounds Modifications- Phase I | Oct. 2008 | September 2009 |
| | | |
| <u>Phase II</u> | | |
| • Spreading Grounds Modifications- Phase II | April 2012 | September 2012 |
| | | |
| <u>Phase III</u> | | |
| • Headworks Rehabilitation | April 2013 | October 2014 |
| • Santa Anita Dam Spillway Modifications, etc | April 2013 | October 2014 |
| • Santa Anita Debris Basin Seismic Remediation | April 2013 | October 2014 |

TASKS

(a) Direct Project Administration Costs

Task 1: Administration

Work to be completed under this task will be performed by a District Project Manager (PM) with assistance from an Assistant Project Manager. The administration tasks will consist of managing the planning, environmental compliance, and design efforts; coordinating with District's budgeting personnel; coordinating with the State on grant management, including invoicing and status reports; and resolving any issues that arise. The PM will also be

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

responsible for coordinating with any non-state funding partner agencies through scheduled meetings, phone and electronic mail communications, and memorandums of understanding (MOUs).

The cost of work performed under this task will be applied as local match.

Task 2: Labor Compliance Program

The District will serve as the construction manager of the Project. The District has an approved Labor Compliance Program (LCP), developed by our consultant, Solis Group. A copy is attached in Appendix 3-B. All future construction contracts to be awarded for the Project will require compliance with the LCP. Solis Group will administer the LCP. If, during the course of project implementation, changes are required to the LCP or a new administrator is required, the District will engage Solis Group or another qualified firm to update and/or administer the LCP.

Task 3: Reporting

The PM and Assistant PM will submit quarterly, annual, and final reports to the State per Proposition 1E contract requirements.

Following completion of work on the Dam to mitigate the seismic and hydrologic deficiencies, DSOD will provide the District with a new certificate permitting operations/impoundment of stormwater in the reservoir consistent with those claimed in this application. When the new certificate is received, a copy will be submitted with the next quarterly report.

Following completion of work on the Debris Basin to mitigate the seismic deficiencies, DSOD will provide the District with a new certificate permitting operations/impoundment of stormwater in the reservoir consistent with those claimed in this application. When the new certificate is received, a copy will be submitted with the next quarterly report.

DSOD inspects the Dam and the Debris Basin annually and prepares an inspection report annually for each facility. The report will provide a conclusion on whether or not the Dam and reservoir are judged satisfactory for continued use in accordance with the certified status.

Following Project completion, the District will measure the total amount of stormwater runoff captured at the Dam and Debris Basin, the amount of stormwater recharged into the Raymond Basin by the spreading grounds, and the amount of runoff discharged downstream into the channel, which is not conserved in the Raymond Basin. These measurements will be reported per storm event and summarized annually. The measurements will be evaluated to assess performance of the Project. Based on the performance, an adaptive management approach

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

will be implemented to adjust operations and control systems to optimize their efficiency to ensure the highest benefit from the Project.

| Reporting Submittals | Due Dates |
|----------------------------|------------------|
| Quarterly Progress Reports | Quarterly |
| Annual Reports | Annually |
| Final Report | After Completion |

(b) Land Purchase / Easement

Not applicable. The District currently owns all of the land upon which the facilities are located.

(c) Planning/ Design/ Engineering/ Environmental Documentation

Task 4: Assessment and Evaluation

DSOD expressed a favorable opinion of the May 2004 concept to relocate the Debris Basin spillway to the left abutment; however, they identified two outstanding concerns with using the basin for water conservation: 1.) *The field observation that led to the 1994 conclusion that the fault exposed on the left abutment does not “significantly displace” alluvium needs to be documented. The fault should be classified in accordance with the DSOD’s Fault Activity Guidelines; and 2.) The previous slope stability analysis was based on limited data. A more thorough soil investigation to adequately assess the stability of the dam is needed.* In response to these concerns, URS developed an April 2009, Work Plan for addressing these issues and has expressed their confidence in obtaining favorable results. That work plan also included a section on Evaluation and Analyses of Spillway Mitigation Concepts as alternatives to relocating the spillway to the left abutment. The District considers that the alternatives may be less costly than the spillway relocation concept that DSOD previously expressed a favorable opinion of. Prior to formally commenting on the alternatives discussed in URS’s Work Plan, DSOD has indicated they would prefer to see the results of the elements of the work plan to address their concerns (items 1 and 2 above). The District is currently in the process of engaging URS to perform these elements of the Work Plan which includes a geotechnical investigation and fault analysis. This work is expected to be completed in September 2011. While those results may favor a less costly mitigation for the Debris Basin Seismic Remediation, the District has, for this grant application, estimated the cost of the seismic remediation based on the spillway relocation to the left abutment and reconstruction of the majority of the embankment.

| Assessment and Evaluation Submittals | Due Dates |
|---|----------------|
| Additional Debris Basin Geotechnical Investigation and Fault Analysis | September 2011 |

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

Task 5: Final Design

The District has completed Final Design plans and specifications of the Dam Seismic Mitigation/Outlet Tower. Final Design plans and specifications for the Spreading Grounds, Phase I, were also completed by the District. Final Design plans and specifications for the Spreading Grounds Phase II and the Headworks Rehabilitation are 60% complete. Final Design of the Dam Spillway Modifications, which are currently 30% complete, will be completed by MWH, the District's consultant. Final Design of the Santa Anita Debris Basin Seismic Rehabilitation will be completed by our consultant, URS. The Debris Basin Design plans are currently 30% complete.

The following table provides the schedule for completion of project plans and specifications at the 90 percent and final level for each component.

| Design Submittals | 90% | 100% |
|---|--------------|--------------|
| Santa Anita Dam Seismic Mitigation/Outlet Tower | Completed | Completed |
| Headworks Rehabilitation | April 2012 | October 2012 |
| Spreading Grounds Modifications- Phase I | Completed | Completed |
| Spreading Grounds Modifications- Phase II | October 2011 | January 2012 |
| Santa Anita Dam Spillway Modifications, etc. | April 2012 | October 2012 |
| Santa Anita Debris Basin Seismic Remediation | April 2012 | October 2012 |

Task 6: Environmental Documentation

An Environmental Impact Report (EIR) for the Santa Anita Dam Seismic Mitigation/Outlet Tower was certified by the Los Angeles County Board of Supervisors on June 9, 2009.

The Dam spillway modification will occur on the Dam crest; however, the reservoir may have to be drained to allow equipment at the upstream base of the Dam to facilitate the construction work. In addition, erosion protection measures will be required immediately below the Dam. The Headworks Rehabilitation will require the levee banks to be graded and the footprint cleared of any vegetation. The footprint of this work will be minimized to reduce the environmental impacts.

The Debris Basin Seismic Remediation will impact some vegetation within the basin. The limits of vegetation removal will be minimized during the final design to reduce those impacts.

Santa Anita Stormwater Flood Management and Seismic Strengthening Project

Work Plan

An appropriate environmental document in conformance with CEQA, likely an EIR or Mitigated Negative Declaration (ND), will be prepared for the Project. It is anticipated to be completed by October 2012. The EIR will address the remaining Dam rehabilitation work including the new spillway, the Headworks Rehabilitation, and the Debris Basin rehabilitation along with cumulative impacts of the other Project components. Prior to preparation of the Draft EIR, an initial study will be prepared.

The Spreading Grounds modification does not involve any work in waters of the United States (U.S.) and is categorically exempt under CEQA. A Notice of Exemption will be filed with the County Clerk for the modifications to this existing facility.

| Environmental Documentation Submittals | Date |
|---|----------------|
| Environmental Impact Report – Santa Anita Stormwater Flood Management and Seismic Strengthening Project | September 2012 |
| Notice of Exemption – Spreading Grounds | March 2012 |

Task 7: Permitting

Work on the Dam, Headworks, and Debris Basin will require permits from the United States Army Corp of Engineers (404 Certifications), Los Angeles Regional Water Quality Control Board (RWQCB) 401 Water Quality Certification, and 1601 Streambed Alteration Agreement with the California Department of Fish and Game (CDFG). Work on the Dam and Debris Basin requires approval from DSOD.

| Permitting Submittals | Date |
|-----------------------|---------------|
| USACOE | November 2012 |
| RWQCB | November 2012 |
| CDFG | November 2012 |
| DSOD | October 2012 |

d) Construction/Implementation

Task 8: Construction Contracting

A construction contract for the Dam Seismic Remediation/Outlet Tower was awarded May 27, 2010. Construction contracting for the remaining Project components will begin once design is complete with the commencement of bid solicitations. Construction contracting will be handled by District staff in compliance with public contracting code. Prior to bid solicitation, the District's governing body, the Los Angeles County Board of Supervisors (Board), is required

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

to approve the Project and certify the environmental document. Tasks to secure the Contract award include: advertisement for bids, a pre-bid contractors meeting, bid opening, bid evaluation and selection of contractor with lowest responsive bid. The Board will then award of the contract unless it has delegated that authority to the Director of Public Works. A Notice to Proceed is then issued.

Task 9: Construction**Task 9.1: Mobilization and Site Preparation**

The contractor for the Project will have a construction trailer on-site for the convenience of managing the construction. Temporary utilities will be installed for the contractor. Construction site entrances and exits will be established early in the mobilization phase to efficiently manage construction vehicle and equipment traffic. Safety meetings will be arranged to make all the parties aware of the potential hazards during construction.

Site preparation will entail any necessary rough grading of the site with the aid of preliminary surveys. Dust, erosion, and noise mitigation measures will be implemented to minimize adverse impacts to the neighboring community. Since the work will be done in phases, it is anticipated that work will proceed at one facility at a time with the exception of the Headworks Rehabilitation, which will be done at the same time as the Debris Basin construction.

Task 9.2: Project Construction

The Project construction will consist of modifying the existing Dam, Debris Basin, Headworks, and Spreading Grounds.

Santa Anita Dam Seismic Remediation/Outlet Tower: This component includes permanent structural modifications to the Dam, including the construction of a 6-foot diameter reinforced concrete outlet tower anchored to the upstream face of the Dam and connected to the existing sluice outlet tunnel. The outlet tower will extend 50 feet from the outlet tunnel to elevation 1230 feet. DSOD considers elevation 1231 feet as the maximum safe reservoir elevation and requires this new free draining (ungated) outlet to meet the seismic requirement of the Dam by preventing long-term impoundment of water above the safe elevation. The existing sluice gate and trashrack will be removed, since they could not be relied upon to be functional for draining the Dam after a large earthquake. The gate could be rendered inoperable by an earthquake, or a storm event or debris deposition could plug the outlet. The new outlet tower is designed to withstand a MCE and will remain functional, even after an earthquake, to ensure that reservoir inflows are drained from the Dam at a rate of up to 1000 cfs. A trashrack will be constructed to extend 50 feet above the new outlet to ensure it is not plugged with storm debris. A new sluice

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

gate with a hydraulic power system and hydraulic lines will be installed on the upstream face of the new outlet tower.

Santa Anita Dam Spillway Modification: The existing spillway will be modified by notching the dam crest to construct an ogee spillway at elevation 1,320 feet and 6 foot diameter orifice spillway at elevation 1,270 feet with a combined capacity to safely pass the PMF flow rate of 26,100 cfs without overtopping the dam. The adjacent abutments and downstream canyon walls will be armored with rockbolts and structural shotcrete for erosion protection from discharges over the new spillway. A concrete pad at the toe of the Dam will be constructed to resist undermining of the Dam foundation by the spillway flows. The concrete removed from the Dam to create the spillway may be recycled and incorporated into the Dam toe protection. The existing Dam hoist used to move equipment and materials to the Dam crest from the nearest staging area accessible to vehicles is located where the new spillway will be constructed and must be removed. A new, higher capacity hoist necessary for the Project construction will be installed on the Dam crest.

Structural improvements to Dam concrete will include grouting of joints; and removal and patching of spalled concrete. To ensure safe performance of the Dam, dam safety instruments including joint and crack meters, piezometers, water level sensors, leakage weirs and accelerometers will be installed with capabilities for remote viewing of data.

The Dam's valves, electrical and control systems will be removed and replaced. Three new Fixed Cone Valves will replace the existing 18-inch and two 30-inch Hollow Jet valves. Three new back-up slide gates will replace the existing back-up gates. New electric motor operators will also be installed with capabilities for local manual and remote operation.

The Debris Basin rehabilitation will consist of replacement of the outlet tower with a new tower capable of withstanding the MCE; replacement of a portion of the Debris Basin embankment subject to liquefaction, and reconstruction of the spillway to address concerns with settlement/separation between the spillway and the embankment. A new outlet gate with electric motor operator capable of local manual and remote operation will be installed in the new outlet tower.

The rehabilitation of the Headworks structure will include: removal and reconstruction of the levee to ensure it can withstand flow up to 1000 cfs; armoring of the roadway and construction of a new bridge to the Arcadia Wilderness Park capable of withstanding flows of up to 2000 cfs; removal of the tainter gate and replacement with a 9-foot high by 15-foot wide Obermeyer Gate with remote operation capabilities; installation of two new automated spreading grounds diversion gates; and installation of new control systems integrated with the control systems of the other Project components to optimize water conservation.

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

The Spreading Grounds enlargement and enhancement Phase I consists of excavating the basin bottom to deepen basins by 3 to 5 feet each and repairing levees between basins by removing unsuitable material and reconstructing.

The Spreading Grounds enlargement and enhancement Phase II consists of further enlarging the capacity of the Spreading Grounds by excavating two new basins. The eastside canal will be armored with rip-rap and drop structures and an overflow structure will be constructed at a higher elevation than the existing overflow structure from Basin 14 to the Santa Anita Wash. Operational enhancements include concrete interbasin spillways to be installed at basins 2, 3, 4, 7, and 8. The basins will be reconfigured. Manual gates and flash-board structures will be removed and replaced with automated electrical gates and control systems. A new inlet pipeline to the new basins will also be constructed.

Task 9.3: Performance Testing and Demobilization

During Project construction, elements such as control gates and valves will be shop tested prior to installation. On site testing will include taking concrete cylinders to verify strength. Dowels used to anchor into existing concrete on the Dam will be “pull tested” to verify bond strength. Construction inspectors will review material data sheets and product labels to verify supplied materials match those specified in the design documents.

DSOD will inspect construction work on the Dam and the Debris Basin to ensure compliance with design.

The final construction subtask will include system integration of control systems and their automated components for maximizing stormwater runoff conservation. The system will be tested upon installation. Valves and gates will also be tested prior to contractor demobilization. During the following storm seasons, an adaptive management approach will be implemented to fine tune the system for optimizing stormwater management and groundwater recharge.

Contractor demobilization will only occur after final inspection and completion of all punch list items identified during final walk through.

e) Environmental Compliance/Mitigation/Enhancement**Task 10: Environmental Compliance/Mitigation/Enhancement**

The final construction specifications will include environmental compliance measures as required by the environmental documents and permits. During construction, the District's Construction Division will designate an environmental compliance inspector to ensure the contractor adheres to the required compliance measures. Any required environmental

**Santa Anita Stormwater Flood Management
and Seismic Strengthening Project****Work Plan**

mitigation or enhancement identified in the document or permits, but not a part of Project construction, will be implemented by the District through in-house forces or by a qualified specialist or contractor through a separate contract.

f) **Construction Administration**

Task 11: Construction Administration

The District has a dedicated Construction Division that administers numerous multi-million dollar civil construction projects every year in conformance with the Public Contracting Code. Construction Division Staff will manage the Project construction contract process and implementation. Construction administration activities will include general preparation of construction documents, advertisement for bids, award of construction contracts, construction contract administration, and construction inspection.